HARMONICS

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WHAT IS AERONAUTICAL ENGINEERING?

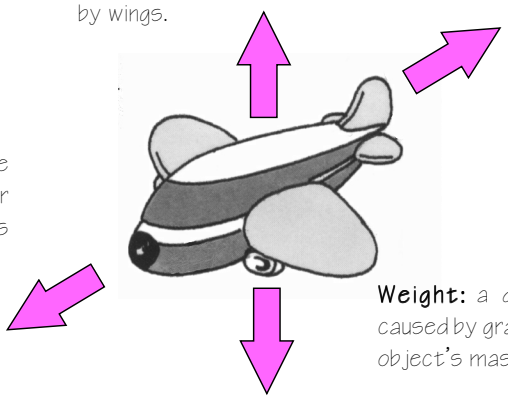
Each year millions of people all over the world climb aboard airplanes and travel from one place to another. Pretty amazing when you consider that flight, as a human endeavour, is less than 100 years old. We have come a long way in a very short time and yet soaring through the air like a bird is an idea which has inspired the imaginations of human beings since the beginning of time. Peoples all over the world have legends and stories about flying, the powers of birds, and gods or spirits which take the form of birds or other flying creatures. Birds, like Raven, Eagle and Owl, play a large role in Native American legends and stories. Birds are inspiring and the legends surrounding them teach us lots about life, but legends didn't teach us how to fly. Great inventors, like the Italian artist Leonardo da Vinci, looked to the birds for inspiration when they began to consider how flight was possible. The mechanical, analytical approach they used in their studies was the start of aeronautics - the science of flight.

In some ways the science of flight is quite simple because there are basically only four forces acting on anything which flies. These forces are:

Lift: an upward force created by wings.

Drag: a backward force created by the friction of air as it passes over the object.

Thrust: a forward force created by the engines or propellers (for birds the wings also create thrust.



Weight: a downward force caused by gravity acting on the object's mass.

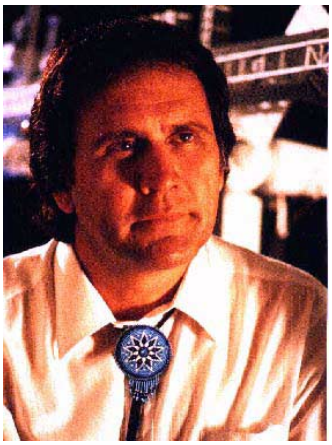
In order for an object to get off the ground there must be enough lift to overcome weight and enough thrust to overcome drag.

Aeronautical engineers are people who know all about the science of flight and use that knowledge to design, create and refine the aircraft and components which allow us to fly. Within aeronautics and aeronautical engineering there are a number of specialised areas in which people work. These include: Propulsion - how the aircraft moves through the air; Structures - how to build lightweight, strong, safe airframes; Performance - how the aircraft actually works, as well as its reliability and efficiency; Controls - how everything from the wing flaps to toilets are controlled during flight and on the ground; Aerodynamics, - how to shape the aircraft in order to create more lift or less drag; and, Design, how to bring all the knowledge of the other aeronautics fields together in order to design and build new aircraft.

So the next time you see an airplane flying over head - whether it's a tiny, 2-seater Cessna or a huge 747 - marvel at how it got off the ground, wonder about the mystery of flight, and know that if you became an aeronautical engineer, even the sky wouldn't limit you!

NATIVE ENGINEERS

A place to meet engineers from your community.



Courtesy of JC High Eagle

Name: Jerry C. High Eagle
Nations: Cherokee and Osage, Oklahoma, USA
Profession: NASA Engineer
School:University of Oklahoma
Degrees: B.Sc. (Physics), Ph.D. in progress
Favourite thing about job: The freedom and creativity together with the opportunity to "see into the future" through the inventions of NASA engineers.

> "Engineering is a sacred profession. It learns about many of the Great Spirit's secrets left here for us to discover and to use for our benefit."

Jerry High Eagle remembers clearly what first made him want to study science,

> "I always had an inquisitive mind. I loved to put puzzles together and build things when I was young. When I was younger, I remember hearing about the Russians beating the United States into space, and launching a satellite into orbit around the Earth. That day, I realized suddenly that here I was in a small town that was never really going to change much, yet there in the news was something out of the future. And I wanted to go there!"

His family were very supportive of his dreams,

> "My family supported me, especially my Grandfather and Mother, to stay in school and get an education. I am the first member of my family to have a college education with degree."

Mr. High Eagle's degree allowed him to witness history first hand, and even to play a part in it. While still a graduate student at university, Mr. High Eagle was recruited by NASA where he soon joined the Moon program. In 1969, when the Apollo 11 Lunar Module (named Eagle) landed on the moon, he was a flight controller in NASA's Mission Control Centre in Houston, Texas. His duties included computing all the parameters which allowed the rocket carrying Neil Armstrong, Buzz Aldrin and Michael Collins to take off and land safely. He says it was the most exciting project on which he has ever worked.

About a year later, Mr. High Eagle had his greatest professional challenge and achievement when he was an operations flight controller during the Apollo 13 (Odyssey) mission. Astronauts Jim Lovell and Fred Haise, were supposed to land the lunar module Aquarius in the Fra Mauro hills of the moon, conduct experiments, take photos and collect moon rocks, while John Sweigart orbited the moon in the Odyssey capsule. About 320,000 km from Earth, after they had docked with the Aquarius but before they reached the moon, one of the Odyssey's oxygen tanks exploded, damaging the ship and leaving it without power and air. The flight engineers at NASA found out about the problem when Jim Lovell radioed back, "Okay, Houston, we've had a problem ..."

NASA engineers and scientists decided that the safest way to bring the Apollo 13 crew home was to abandon the moon landing but let them orbit the moon once. This way they could use the moon's gravity to help slingshot them back towards Earth. Mr. High Eagle was in charge of computing the return-to-earth trajectory, the path which would bring the astronauts safely home.

> "I participated in the greatest challenge and noblest adventure in mankind's history. The successful return of Apollo 13 is a story of strong determination in the face of suspense and tragedy, but technical competence mixed with plain, old-fashion common sense, made us fearless and undaunted."

For his part in the Apollo 13 mission, Mr. High Eagle was presented by with his nation' s highest civilian honour, the Presidential Medal of Freedom.

Today. Mr. High Eagle continues to work at NASA in the Office of Technology Transfer and Commercialization. Part of his job is to do technical evaluations of NASA inventions and research and then figure out how they might be used to benefit society. While this is

Courtesy of JC High Eagle

a field completely different from flight control, Mr. High Eagle feels his engineering background has prepared him for the challenge,

"Engineering fine-tuned my ability to reason, to think. With its knowledge and principles, I could apply information to anything … It gave me a better sense of confidence in myself … Engineers and scientists are doers. We are tinkerers, and like to build things. We like to figure things out …. We are educated to deal in facts and to be logical in our thinking, but … we are people too! To be a good scientist or engineer is to be a good human with care and concern for both humanity and the environment."

Mr. High Eagle is not only an accomplished scientist, he is also a musician and an activist. He has performed on the American Indian flute with the National Symphony at the John F. Kennedy Centre for Performing Arts. He also designed an international site for peace which lies on the equator in the South American country of Ecuador.

Mr. High Eagle believes education, and particularly science and engineering education, are essential for the future of Aboriginal peoples.

"We cannot ignore that the future of our people will clearly depend on the presence of well-trained, well-educated engineers and others in technical fields. Whatever we plan or do to meet the future needs of our people will not happen unless you make it happen. We will be successful in our efforts to achieve a better tomorrow only if you have the will, the energy, and the desire to bring it about. Remember no person can be better than their own preparation. Without education, we cannot survive.

I challenge you who are proud of your family, proud of your heritage, to achieve an education that will make the future point to you with even more pride than the present. I challenge you to accomplish more than those of us who have gone before you; I challenge you to shoulder more responsibility, to launch out into the deep and do something; I challenge you to make life obey you, not you obey it."

The University of Oklahoma is a state-run institution offering degrees through 18 colleges including: Architecture, Arts and Science, Business Administration, Education, Engineering, Law, Dentistry, Medicine, Pharmacy and Nursing. It has campuses in Norman, Tulsa and Oklahoma City. For more information about the university contact the Admissions Office at Buchanan Hall 127, 1000 Aap Avenue, Norman, Oklahoma. Tel: 405-325-2252, Fax: 405-325-7124. Website: http://www.ou.edu

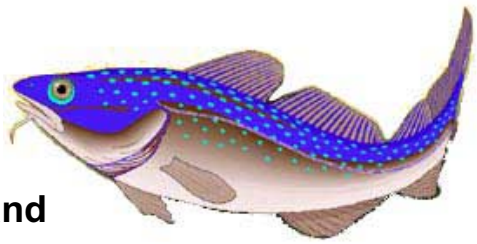
AIR CREEBEC: 100% CREE-OWNED!

Air Creebec has come a long way since its beginnings 20 years ago. It is a $27 million-a-year business that flies 60,000 people annually. Its fleet of 10 planes fly air cargo and passengers to urban centers and numerous northern Native communities in Quebec and Ontario. As well, they provide charter flights throughout Canada.

The Crees seriously considered developing an air transport business as far back as the signing of the James Bay Agreement in 1976. In 1979, they entered into a joint venture with Austin Airways, a company already servicing the North. Albert Diamond, Air Creebec's President explains, "In their wisdom, the chiefs (the Council of the Cree Regional Authority) said, 'We have never run an airline – perhaps, the best thing is to set up a joint venture for a number of years to learn about the aviation business.'" It was a wise decision which paid off quickly; three years later, in 1982, the Cree owned 51% of the shares in the joint company, and, in 1988, they became whole owners by buying out their partner.

With headquarters in Val D'Or and a maintenance crew in Timmins, Ontario, AirCreebec employs 180 personnel: 131 full-time and 49 part-time. It also continues to expand. The company is now negotiating an agreement with Air Alliance (an Air Canada affiliate) in a deal, which Mr. Diamond says will "pretty well establish the life of Air Creebec all over Quebec. It would probably ensure the Crees of Quebec stay in the aviation business for a long time to come."

The information for this article was obtained from "The Winds of Change" magazine, Fall 1998 issue and http://aircreebec.ca/general_eng.htm and http://aircreebec.ca/schedules.htm)



COMMUNITY PROFILE

Miawpukek Mi'kmaq of Conne River, Newfoundland

Located on the southern coastal waters of Newfoundland in Baie d'Espoir, the Mi'kmaq community of Conne River is nestled among vast forests and mountains. It's easy to understand how nature has been an inspiration to its 800 community members on their journey to economic self-sufficiency.

In the short period of time since Conne River officially was recognized as a status Indian Reserve in 1985, the community has become a model of Aboriginal enterprise. It owns and manages several businesses including a flourishing aquaculture (fish hatchery) program, hunting and fishing lodges and a logging operation. The collective community vision is to create economic development guided by traditional values.

Miawpukek Aquaculture stands out as a concrete example of this vision. Using traditional knowledge of the sea, the community created a company that harvests, processes and markets fish at a very high volume. What makes it especially exciting is the involvement of the First Nation high school students of Conne River. They can take 3 levels of courses in salmonid aquaculture at Ste. Anne's School on the reserve. (A salmonid is a fish of the family Salmonides which includes salmon, trout and char.)

The Level I course involves activities that take place at a hatchery (also known as a fish culture station). Students follow the development of the fish from spawning right up to the point at which they are ready to be transported to sea cages. In Level II, students learn all about the grow-out of salmonids, from the transport to the cages until the fish are harvested and processed. Level III is an Enterprise course which focuses on getting the fish ready for market; students complete the course by creating their own business plans.

As student Miles Cornish explains, these courses are exciting because they are not all bookwork, "This afternoon, we will dissect fish (steelhead trout, brook trout, salmon) to learn about the inside parts. Starting next month, we will be going to the local fisheries site to strip the fish: removing the eggs and putting them in an incubation system."
People from the community also make a contribution to the courses Jackie Leclaire from Conne River says, "Guest speakers from the hatchery go in to the classroom to speak to the students. For example, they will show them parts of the fish, or explain how they spawn. Elders who know how to fish tell the students about the many kinds of fish, places they fish and what kinds of fish are plentiful at certain times of the year."

This industry is offering the youth of Conne River a very promising future as Miles Cornish knows, "Aquaculture is rapidly growing in Newfoundland. I want to become very experienced with the business."

The information for this article was obtained through an interview with Jackie Leclaire, Mi'kmaq from Conne River who team teaches at the Kahnawake Survival School and http://www.stemnet.nf.ca/finaly/YouthHighTide/Sci_and_Tech/aquaculture.html and http://www.inac.gc.ca/pubs/fnepi/ecdev1.html .

THE EAGLE HAS LANDED

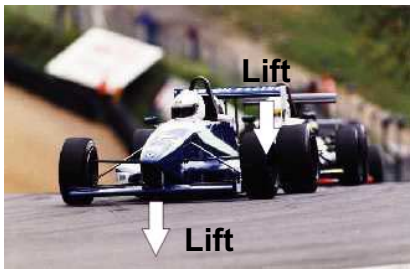
The bald eagle is an inspiring symbol of power and grace. In Native spiritual teachings, the eagle is revered because it is considered the highest flying creature of the skies and carries prayers to the Creator.

Did you know that when man first journeyed to the Moon in July 1969, the Lunar Module that landed was named the "Eagle"? When it touched the Moon's surface, the famous words uttered were, "....the Eagle has landed..."

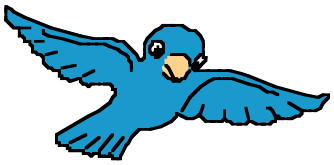
Native prophecies foresaw the time when the eagle would circle the moon and land upon it. They say that this would be the start of a new time and power for Native people.
Sources:http://www.alaska.net/~peace/hopi.htm and http://www.historyplace.com/unitedstates/apollo11/index.html

FUN FACTS AND THINGS TO THINK ABOUT

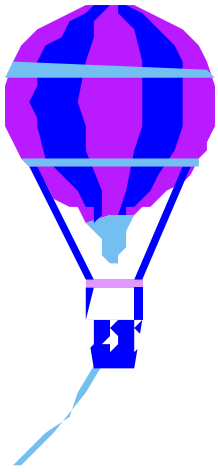
Racing cars have wings. The airfoils on a racing car are actually upside down wings. They create lift in a down ward direction to help keep the car on the ground!



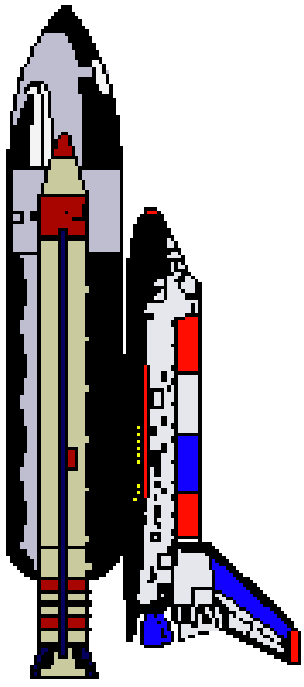
A bird is an instrument working according to mathmatical law, which instrument it is within the capacity of man to reproduce with all its movements.
Leonardo DaVinci.



Balloons are actually more like boats than airplanes. They are lighter than air and so they float in the air just like boats float in the water.



Did you know ...
...the space shuttle is an aircraft when it is in the Earth's atmosphere and a spacecraft only when it is in orbit?



You do not really understand something unless you can explain it to your grandmother.
- Albert Einstein

ENGINEERING NEWS

Aviation Project Being Developed By Kahnawake Mohawks

When the Griffiths Airforce Base in northern New York was closed due to US military spending cutbacks, the Mohawk Council of Kahnawake saw an opportunity to use the facilities for the reserve's future. It is negotiating a partnership with a US firm to start a jointly owned and operated aircraft maintenance company on the deactivated base. The members of the Griffiths Local Development Corporation, which manages the base, are delighted. Their first words to the Council were, "Welcome back to Mohawk Territory;" Griffiths lies on ancestral lands.

One of the immediate goals of this venture is to convert the deactivated base, located near Rome, N.Y. (367 km south of Montreal) into a maintenance facility for narrow-bodied commercial airliners aircraft such as 727s, 757s, DC9s, Airbus 320's. A second goal is for Kahnawake to develop training programs for aircraft mechanics, managers and other careers in aviation.

Opportunities for employment will be plentiful. A recruitment strategy is being developed for positions, including management, support staff, supervisors, technicians, construction and maintenance. New York State has offered subsidies to create 300 jobs by the year 2002. It is estimated that a total of 1,000 jobs will be created by the fifth year of the project. The Kahnawake Council's goal is for Mohawks to fill at least 25% of these jobs, lessening unemployment on reserve. The Council also hopes that the project will present realistic career goals to high school students.

In its startup phase the project will require skilled workers in occupations such as welding, carpentry and painting. For more technical jobs that need Federal Aviation Agency certification, such as airframe technicians, engine maintenance and overhaul, aircraft inspector, etc., the plan is to provide training at the site in Griffiths, in Montreal or in technical schools. When the project is in full-swing, it will require a number of aircraft maintenance engineers whose job will be to certify the aircrafts' airworthiness after maintenance.

While the project is still in the planning and development stage, the Council has created a corporate body called the Kahnawake Aviation Resource Authority (KARA) to oversee its progress. Once the negotiations are finalized, KARA will become one of two partners to own and run Aviation Resources Limited Liability Corporation. KARA's responsibility will be to oversee projects, receive funds, make investments and re-invest profits back into Kahnawake to create more jobs and training within the aviation field. The US partner will provide expertise and marketing.

Rose Ann Morris, one of the main project development officers of KARA says, "This is a good industry to get into. Whether or not the project gets off the ground, we can use the information we've gathered for business such as the training of staff. It seems that all aircraft maintenance industries are short of qualified people."

Grand Chief of Kahnawake, Joe Norton, firmly believes that this project is a positive move that will bring Kahnawake people back into traditional Mohawk territory without confrontation. He also feels that it has potential to expand into other areas and has incalculable economic, social and political benefits. For further information, you can contact the KARA office: Telephone: (450) 635-8551/635-1059 or Fax: (450)635-2280.

The information in this article was obtained from several issues of the Kahnawake newspaper, the Eastern Door and publications from KARA.

ALL ABOUT US

The Native Access to Engineering Program at Concordia University is a joint project of the Faculty of Engineering and Computer Science and l'Ordre des ingénieurs du Québec. It has been running since 1993 with the goal of introducing young Aboriginal people and their teachers to engineering and its connection to economic development. The project's ultimate goal is to increase the representation of Aboriginal peoples among the ranks of professional engineers in Canada.

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